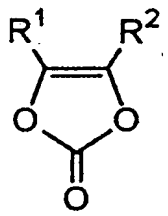
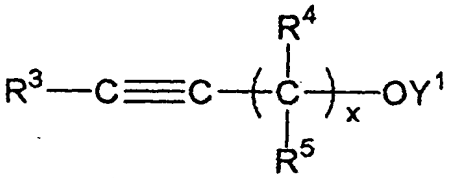
CLAIMS

1. A non-aqueous electrolytic solution comprising an electrolyte salt in a non-aqueous solvent for a lithium secondary battery, wherein the non-aqueous electrolytic solution further contains a vinylene carbonate compound represented by the formula (I) in an amount of 0.01 to 10 wt.%, and at least one alkyne compound represented by the formula (II), (III), (IV), (V), (VI), or (VII) in an amount of 0.01 to 10 wt.%:



(I)

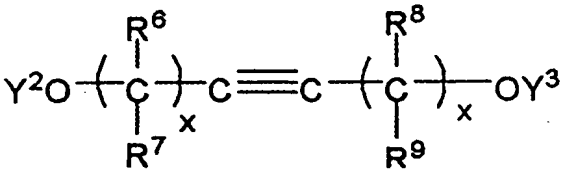
in which each of R^1 and R^2 independently is a hydrogen atom or an alkyl group having 1 to 4 carbon atoms;



(II)

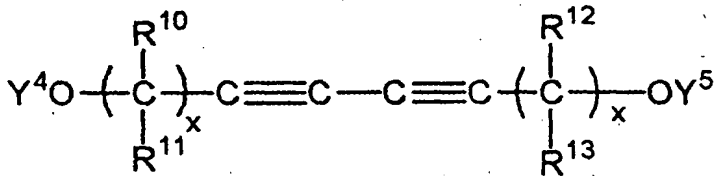
in which each of R^3 to R^5 independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R^4 and R^5 are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; and Y^1 is $-COOR^{20}$, $-COR^{20}$, or $-SO_2R^{20}$, wherein R^{20} is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a

cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms;



(III)

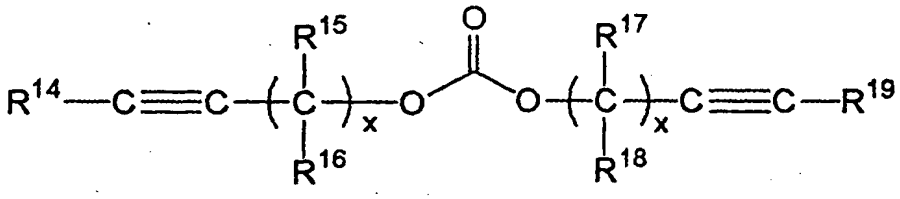
in which each of R^6 to R^9 independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R^6 and R^7 or R^8 and R^9 are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; Y^2 is $-COOR^{21}$, $-COR^{21}$, or $-SO_2R^{21}$, wherein R^{21} is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; and Y^3 is $-COOR^{22}$, $-COR^{22}$, or $-SO_2R^{22}$, wherein R^{22} is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms;



(IV)

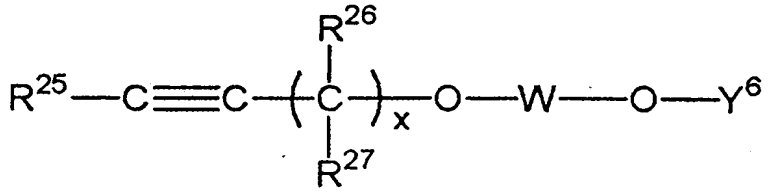
in which each of R^{10} to R^{13} independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R^{10} and R^{11} or R^{12}

and R^{13} are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; Y^4 is $-COOR^{23}$, $-COR^{23}$, or $-SO_2R^{23}$, wherein R^{23} is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; and Y^5 is $-COOR^{24}$, $-COR^{24}$, or $-SO_2R^{24}$, wherein R^{24} is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms;



(V)

in which each of R^{14} to R^{19} independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms, or R^{15} and R^{16} or R^{17} and R^{18} are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; and x is 1 or 2;



(VI)

in which each of R^{25} to R^{27} independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group

having 7 to 12 carbon atoms, or R^{26} and R^{27} are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms; x is 1 or 2; W is sulfinyl, sulfonyl, or oxalyl; and Y^6 is an alkyl group having 1 to 12 carbon atoms, an alkenyl group having 2 to 12 carbon atoms, an alkynyl group having 2 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group having 7 to 12 carbon atoms;

(VII)

in which R^{28} is an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; R^{29} is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, or an aryl group having 6 to 12 carbon atoms; and p is 1 or 2.

2. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains the vinylene carbonate compound in an amount of 0.05 to 5 wt.%.

3. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains the vinylene carbonate compound in an amount of 0.1 to 3 wt.%.

4. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains the alkyne compound in an amount of 0.05 to 5 wt.%.

5. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution contains the alkyne compound in an amount of 0.1 to 3 wt.%.

6. The non-aqueous electrolytic solution of claim 1, wherein the vinylene carbonate compound is vinylene carbonate.

7. The non-aqueous electrolytic solution of claim 1, wherein the alkyne compound is 2-propynyl methyl carbonate, 2-propynyl methanesulfonate, 2-butynylene bis(methyl carbonate), 2-butynylene bis(methanesulfonate), 2,4-hexadiynylene bis(methyl carbonate), di(2-propynyl) carbonate, di(2-propynyl) sulfite, di(2-propynyl) oxalate, phenylacetylene, ethyl 2-propynyl oxalate, 2-propynyl formate, 2-butynylene diformate or 2,4-hexadiynylene diformate.

8. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution further contains an aromatic compound in an amount of 0.1 to 5 wt.%, said aromatic compound being selected from the group consisting of cyclohexylbenzene, a fluorocyclohexylbenzene compound, biphenyl, terphenyl, diphenyl ether, 2-fluorophenyl phenyl ether, 4-fluorophenyl phenyl ether, fluorobenzene, difluorobenzene, 2-fluorobiphenyl, 4-fluorobiphenyl, 2,4-difluoroanisole, tert-butylbenzene, 1,3-di-tert-butylbenzene, 1-fluoro-4-tert-butylbenzene, tert-pentylbenzene, tert-butyl biphenyl, tert-pentyl biphenyl, a partially hydrogenated o-terphenyl, a partially hydrogenated m-terphenyl and a partially hydrogenated p-terphenyl.

9. The non-aqueous electrolytic solution of claim 1, wherein the non-aqueous electrolytic solution further contains a mixture having a weight ratio of 50:50 to 10:90 in a total amount of 0.1 to 5 wt.%, said mixture being selected from the group consisting of a mixture of biphenyl and cyclohexylbenzene, a mixture of cyclohexylbenzene and tert-butylbenzene, a mixture of cyclohexylbenzene and tert-pentylbenzene, a mixture of biphenyl and fluorobenzene, a mixture of cyclohexylbenzene and fluorobenzene, a mixture of 2,4-difluoroanisole and cyclohexylbenzene, a mixture of cyclohexylbenzene and 1-fluoro-4-tert-butylbenzene, a mixture of cyclohexylbenzene and a fluorocyclohexylbenzene compound, a mixture of a fluorocyclohexylbenzene compound and fluorobenzene, and a mixture of 2,4-difluoroanisole and a fluorocyclohexylbenzene compound.

10. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode comprises lithium mixed oxide, wherein the negative electrode comprises a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.

11. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode is a positive electrode composition layer having a density in the range of 3.2 to 4.0 g/cm^3 provided on aluminum foil, said positive electrode layer composition layer comprising lithium mixed oxide, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.

12. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the negative electrode comprises a negative electrode composition layer having a density in the range of 1.3 to 2.0 g/cm^3 provided on copper foil, said negative electrode layer composition layer comprising a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.

13. A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode comprises a positive electrode composition layer having a density in the range of 3.2 to 4.0 g/cm^3 provided on aluminum foil, said positive electrode layer composition layer comprising lithium mixed oxide, wherein the negative electrode comprises a negative electrode composition layer having a density in the range of 1.3 to 2.0 g/cm^3 provided on copper foil, said negative electrode layer composition layer comprising a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution is the solution defined in claim 1.